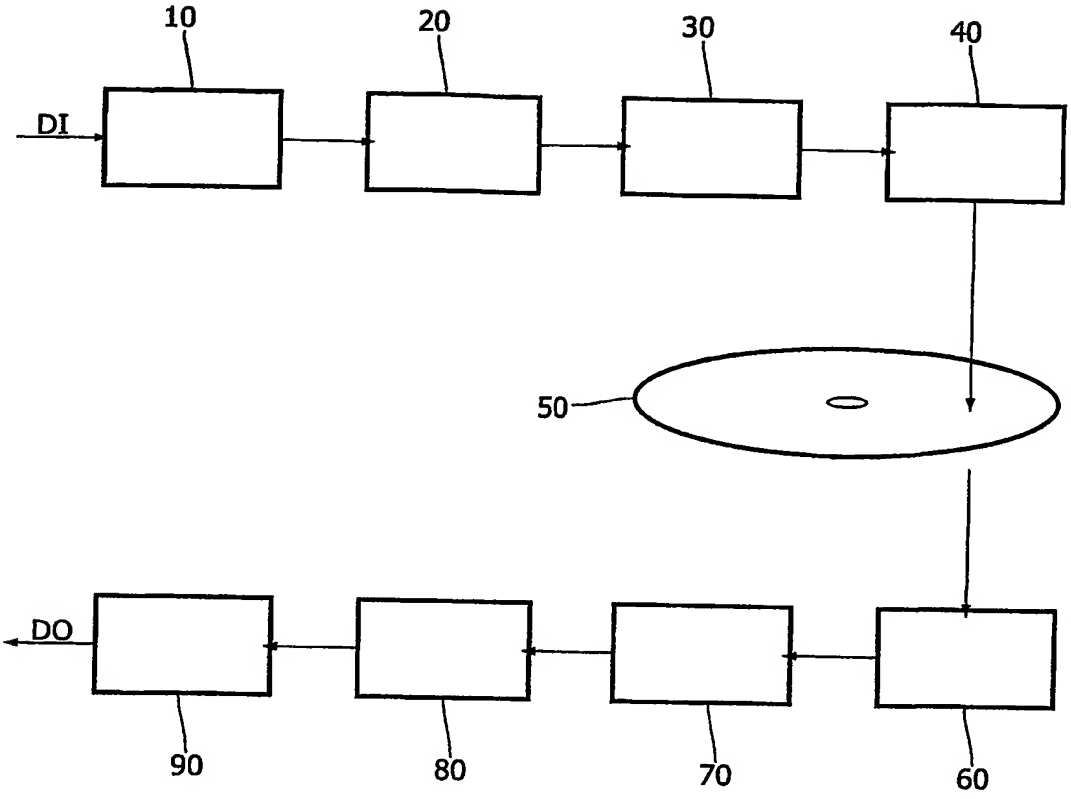
10
20
30
40
DI
50
DO
90
80
70
60

FIG.1

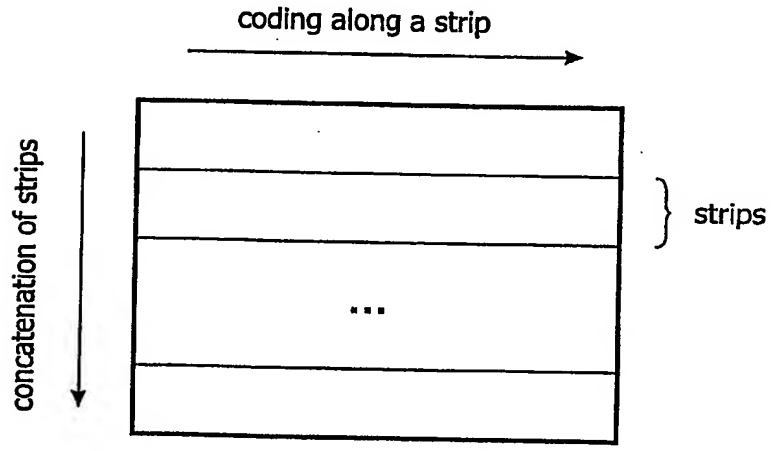
coding along a strip
concatenation of strips
strips
...

FIG.2

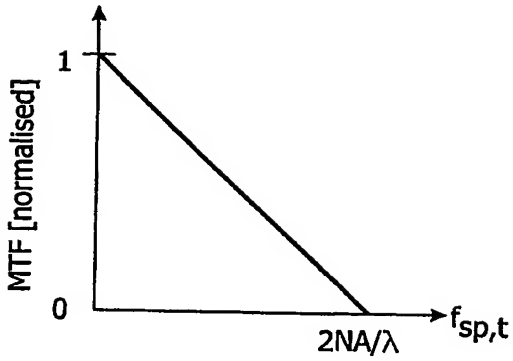

FIG.3a

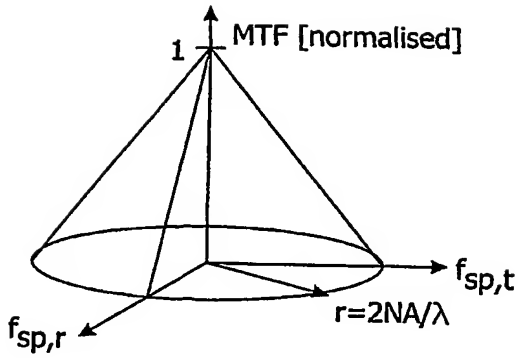

FIG.3b

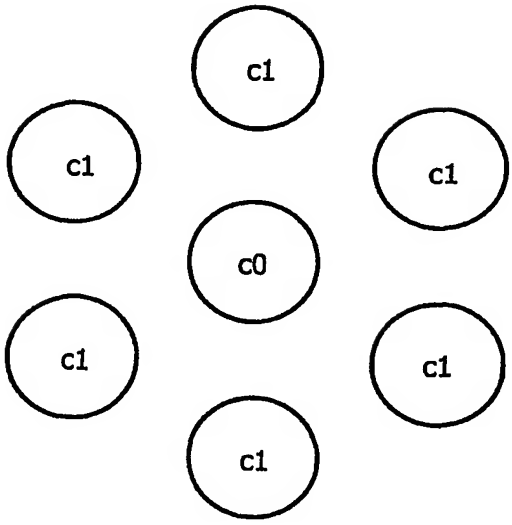

FIG.4

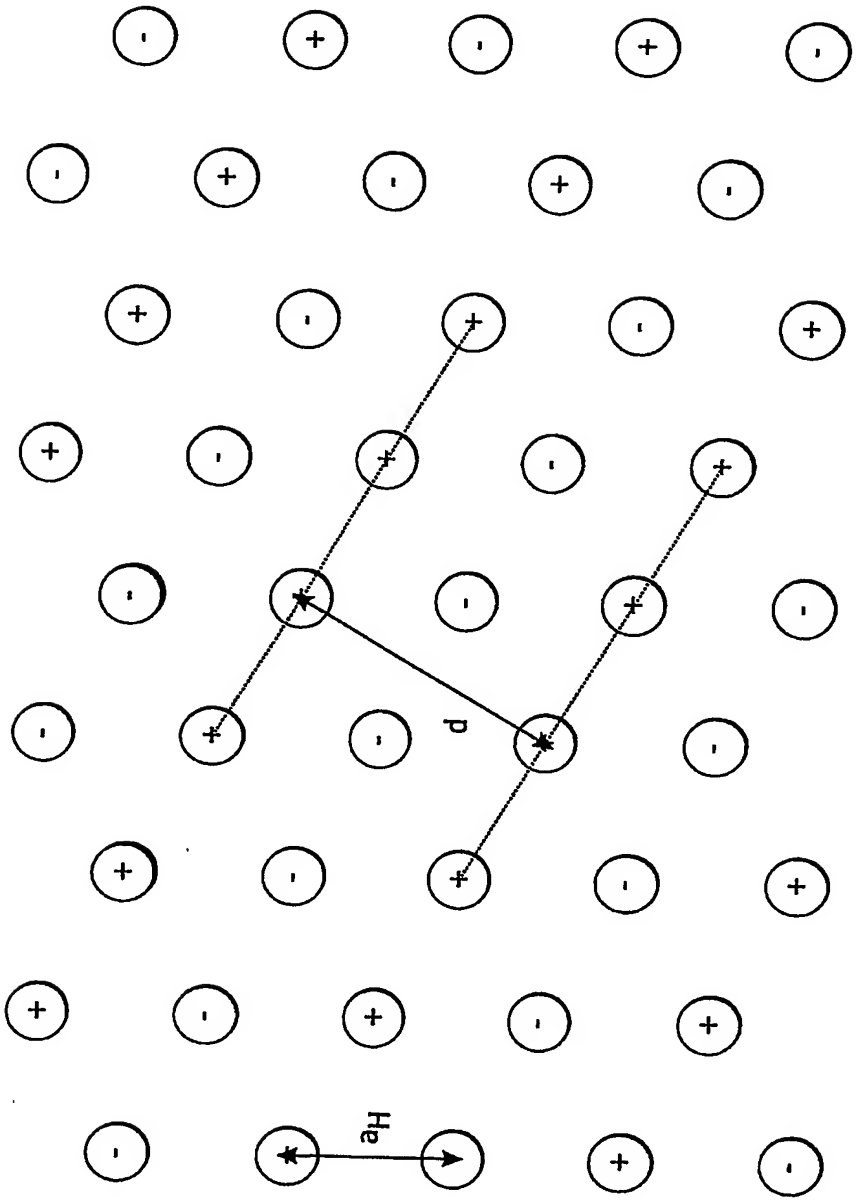

FIG.5

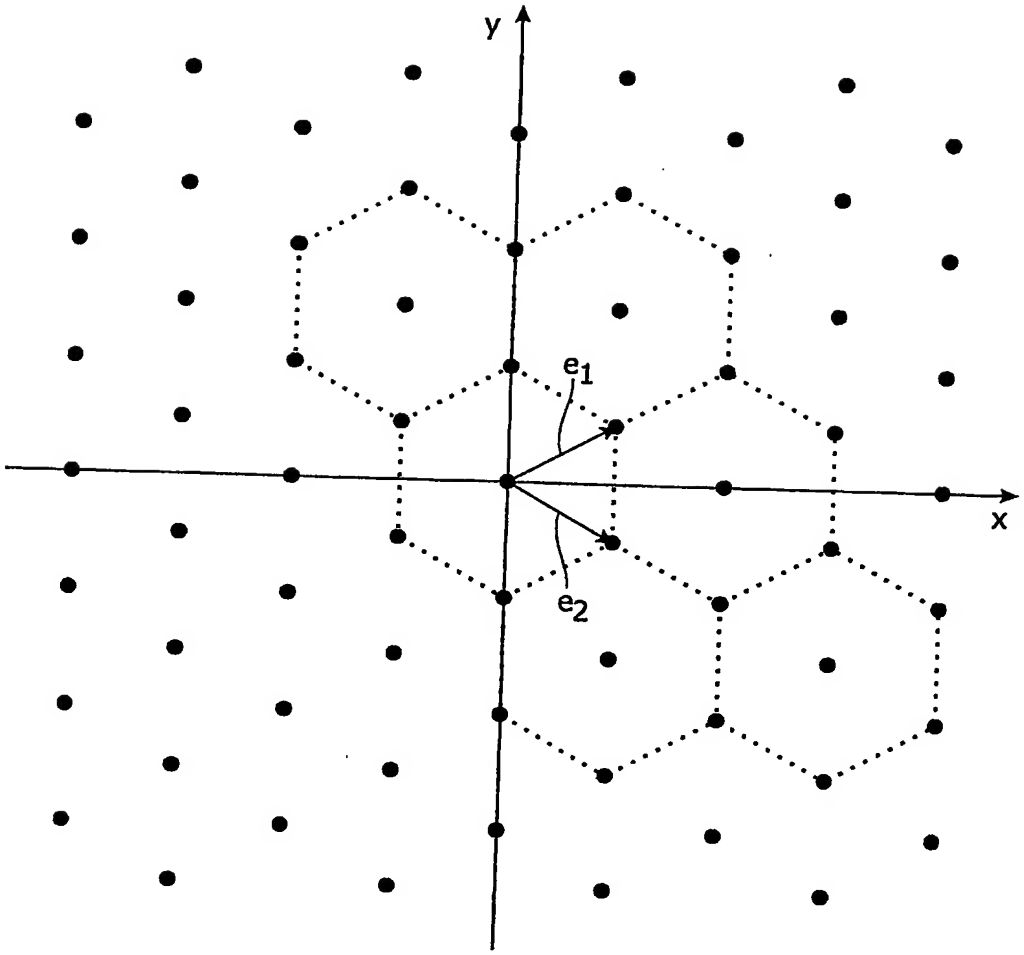

FIG.6

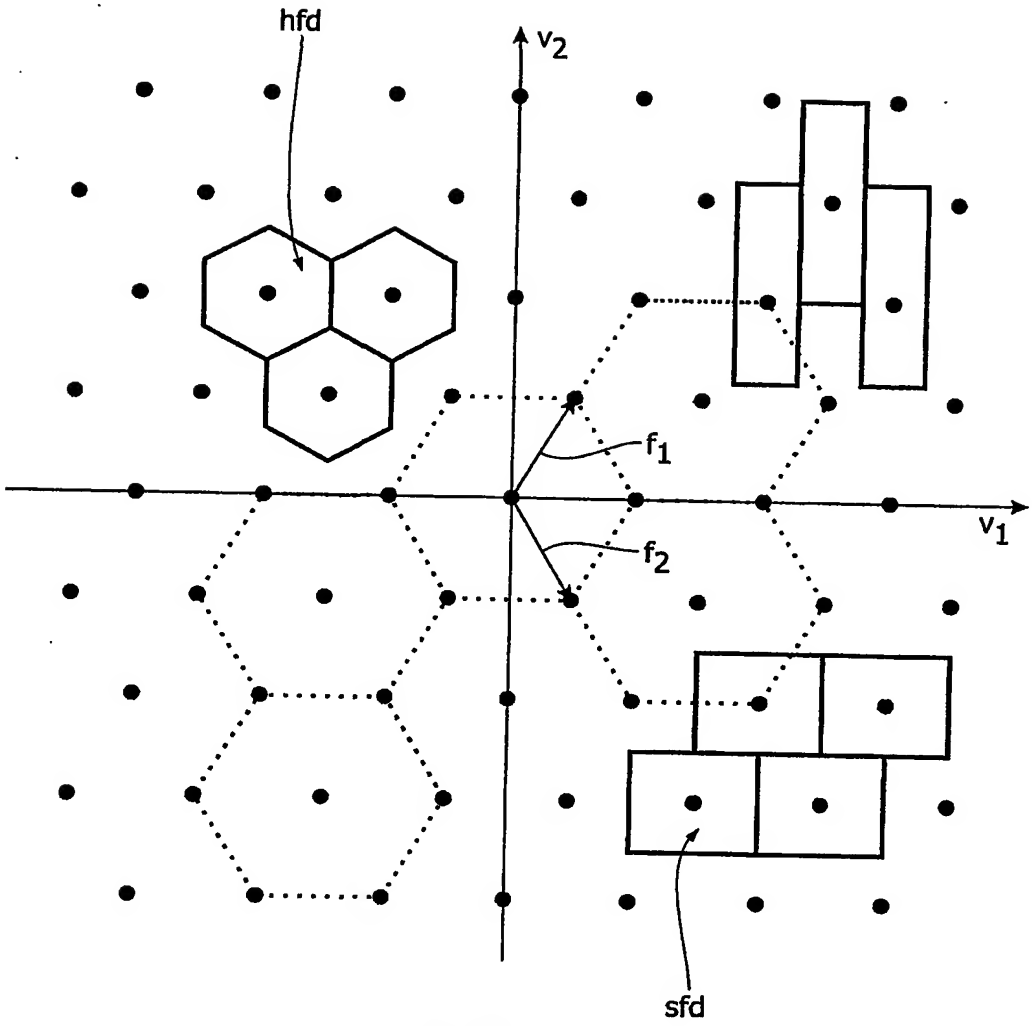

FIG.7

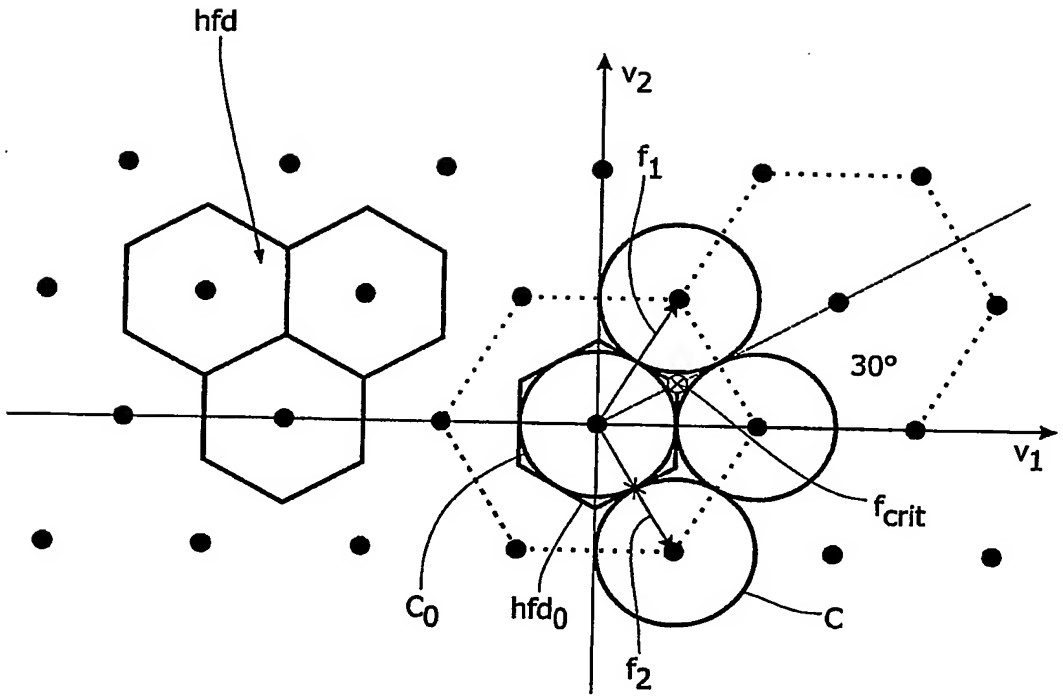

FIG.8

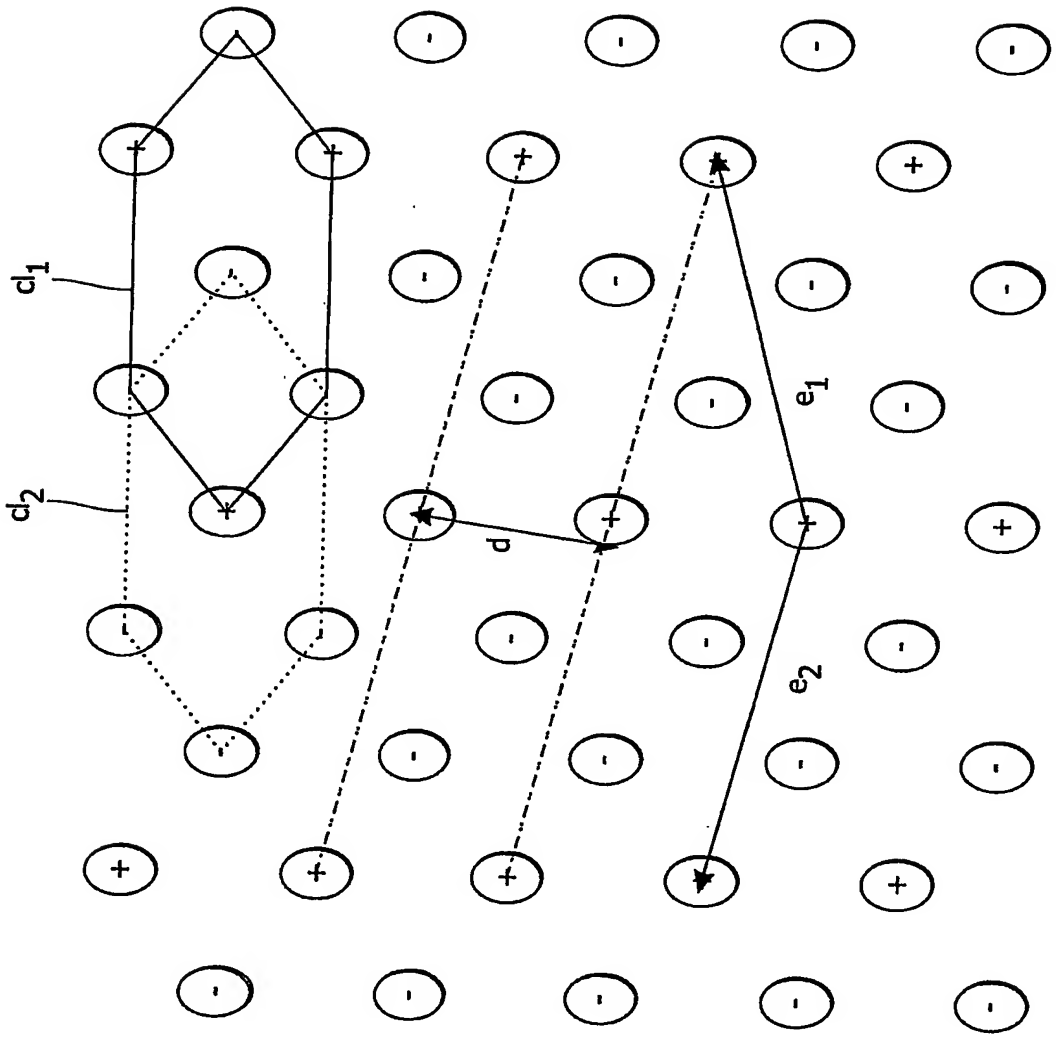

FIG.9

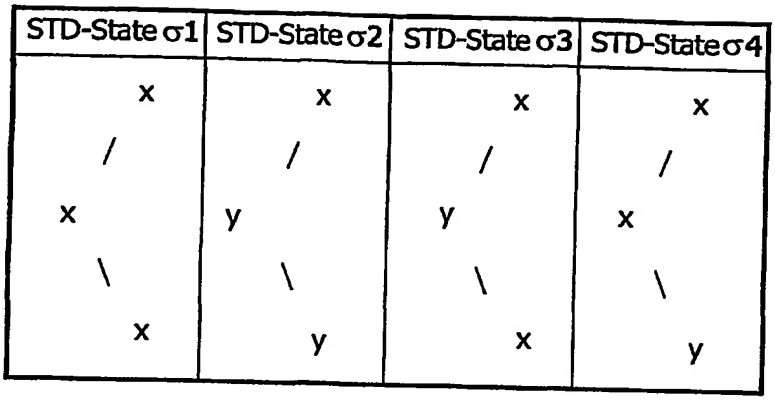

FIG.10

Current NRZI triplet	Channel symbol	Next NRZI triplet
b_{i1}	$\rightarrow i \rightarrow$	$b_{i2} = b_{i1}(-1)^i$
b_{j1}	$\rightarrow j \rightarrow$	$b_{j2} = b_{j1}(-1)^j$
b_{k1}	$\rightarrow k \rightarrow$	$b_{k2} = b_{k1}(-1)^k$

FIG.11

rep. period	3	5
pat.1	0 1 0 1 0 0 0 1 0	0 1 0 1 0 1 0 0 0 0 0 1 1 1 0
pat.2	1 0 1 0 1 1 1 0 1	1 0 0 0 1 0 1 1 1 1 1 0 1 0 1

FIG.12

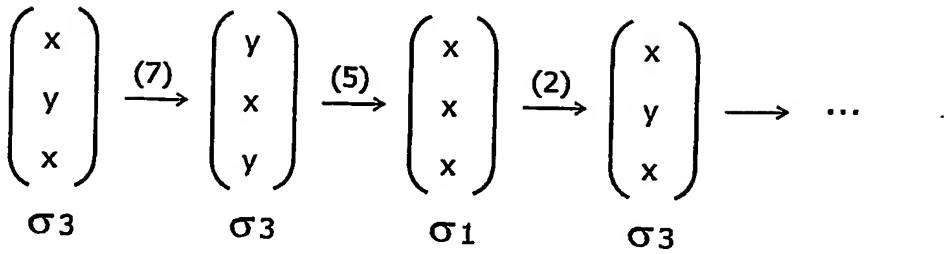

FIG.13

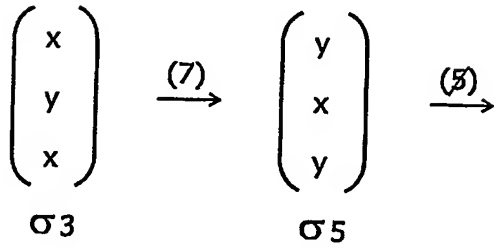

FIG.14a

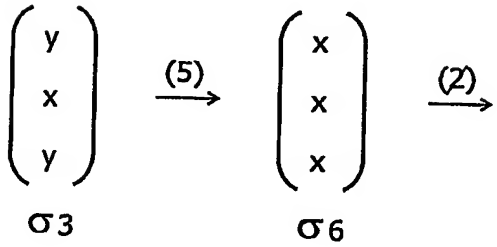

FIG.14b

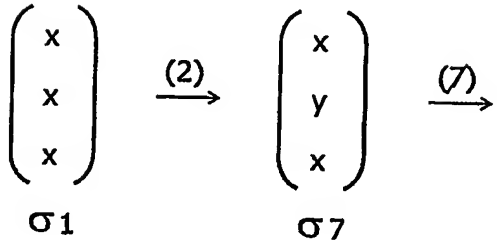

FIG.14c

STD	Symbol							
	[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]
σ_1	σ_1	σ_2	σ_7	σ_4	σ_4	σ_3	σ_2	σ_1
σ_2	σ_2	σ_1	σ_4	σ_3	σ_3	σ_4	σ_1	σ_2
σ_3	σ_3	σ_4	σ_1	σ_2	σ_2	σ_6	σ_4	σ_5
σ_4	σ_4	σ_3	σ_2	σ_1	σ_1	σ_2	σ_3	σ_4
σ_5	σ_3	σ_4	σ_1	σ_2	σ_2	X	σ_4	σ_5
σ_6	σ_1	σ_2	X	σ_4	σ_4	σ_3	σ_2	σ_1
σ_7	σ_3	σ_4	σ_1	σ_2	σ_2	σ_6	σ_4	X

FIG.15

STD	σ_1	σ_2	σ_3	σ_4	σ_5	σ_6	σ_7	
σ_1	2	2	1	2	0	0	1	
σ_2	2	2	2	2	0	0	0	
σ_3	1	2	1	2	1	1	0	
σ_4	2	2	2	2	0	0	0	= D
σ_5	1	2	1	2	1	0	0	
σ_6	2	2	1	2	0	0	0	
σ_7	1	2	1	2	0	1	0	

FIG.16

STD	σ_1	σ_2	σ_3	σ_4	σ_5	σ_6	σ_7	σ_1'	σ_2'	σ_3'	σ_4'	σ_5'	σ_6'	σ_7'
σ_1	1	2	1	2	0	0	1	1	0	0	0	0	0	0
σ_2	2	1	2	2	0	0	0	0	1	0	0	0	0	0
σ_3	1	2	0	2	1	1	0	0	0	1	0	0	0	0
σ_4	2	2	2	1	0	0	0	0	0	0	1	0	0	0
σ_5	1	2	0	2	1	0	0	0	0	1	0	0	0	0
σ_6	1	2	1	2	0	0	0	1	0	0	0	0	0	0
σ_7	1	2	0	2	0	1	0	0	0	1	0	0	0	0
σ_1'	1	2	1	2	0	0	1	0	0	0	0	0	0	0
σ_2'	2	1	2	2	0	0	0	0	0	0	0	0	0	0
σ_3'	1	2	0	2	1	1	0	0	0	0	0	0	0	0
σ_4'	2	2	2	1	0	0	0	0	0	0	0	0	0	0
σ_5'	1	2	0	2	1	0	0	0	0	0	0	0	0	0
σ_6'	1	2	1	2	0	0	0	0	0	0	0	0	0	0
σ_7'	1	2	0	2	0	1	0	0	0	0	0	0	0	0

$= D$

FIG.17

x_1	x_2	x_3	$i_S(x)$
0	0	0	0
0	0	1	$1.n_S(0,0,0) = 1.1=1$
0	1	0	$1.n_S(0,0) = 1.2=2$
0	1	1	$1.n_S(0,0)+1.n_S(0,1,0) = 2+1=3$
1	0	0	$1.n_S(0) = 4$
1	0	1	$1.n_S(0)+1.n_S(1,0,0) = 4+1=5$
1	1	0	$1.n_S(0)+1.n_S(1,0) = 4+2=6$
1	1	1	$1.n_S(0) + 1.n_S(1,0) + 1.n_S(1,1,0) = 4+2+1=7$

FIG.18

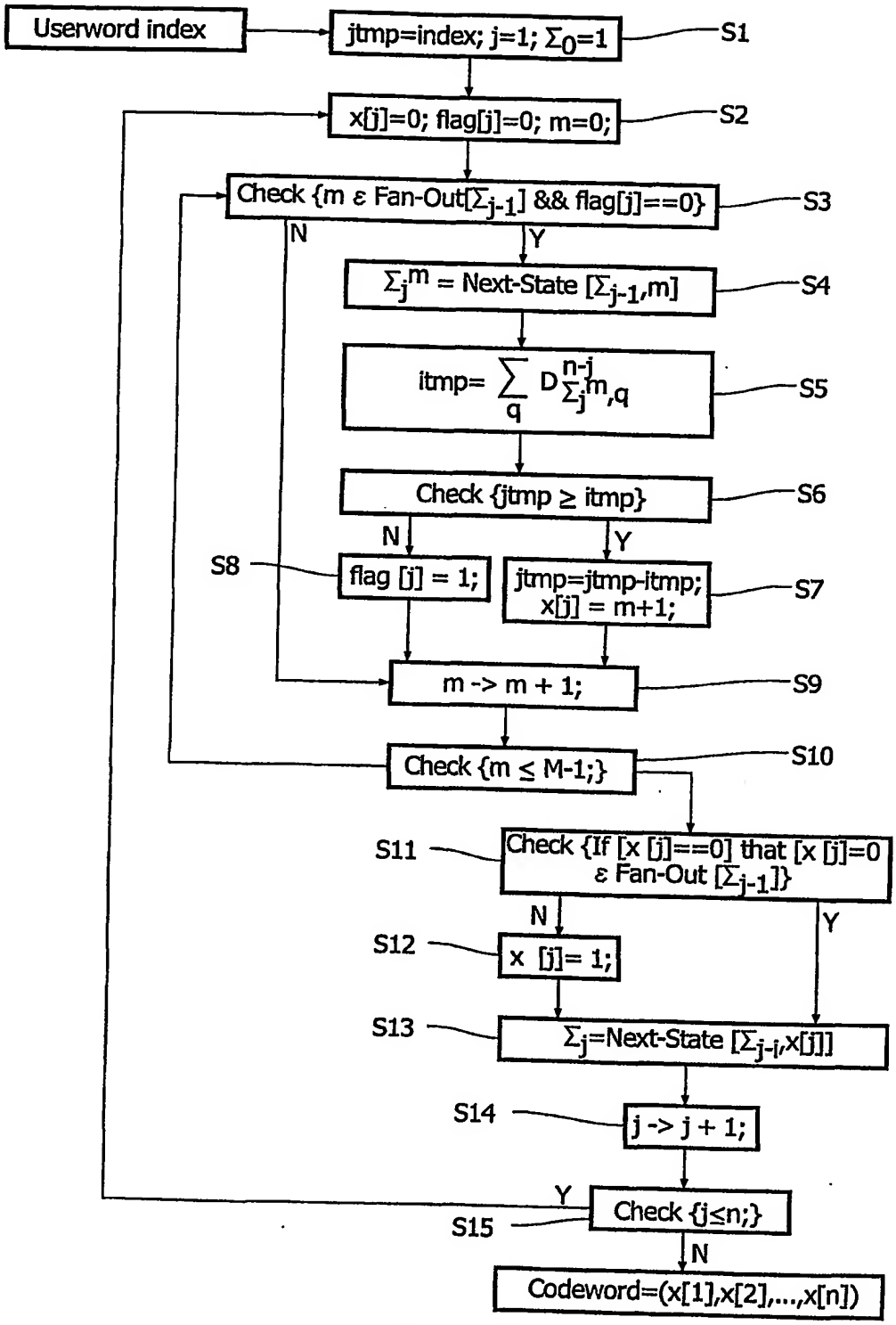
Userword index
jtmp=index; j=1; Σ0=1
S1
x[j]=0; flag[j]=0; m=0;
S2
Check {m ε Fan-Out[Σj-1] && flag[j]==0}
S3
N
Y
Σjm = Next-State [Σj-1,m]
S4
itmp= Σq Dn-jΣjm,q
S5
Check {jtmp ≥ itmp}
S6
N
Y
S8
flag [j] = 1;
jtmp=jtmp-itmp;
x[j] = m+1;
S7
m -> m + 1;
S9
Check {m ≤ M-1;}
S10
S11
Check {If [x [j]==0] that [x [j]=0
ε Fan-Out [Σj-1]}
N
Y
S12
x [j]= 1;
S13
Σj=Next-State [Σj-i,x[j]]
S14
j -> j + 1;
Y
S15
Check {j≤n;}
N
Codeword=(x[1],x[2],...,x[n])

FIG.19

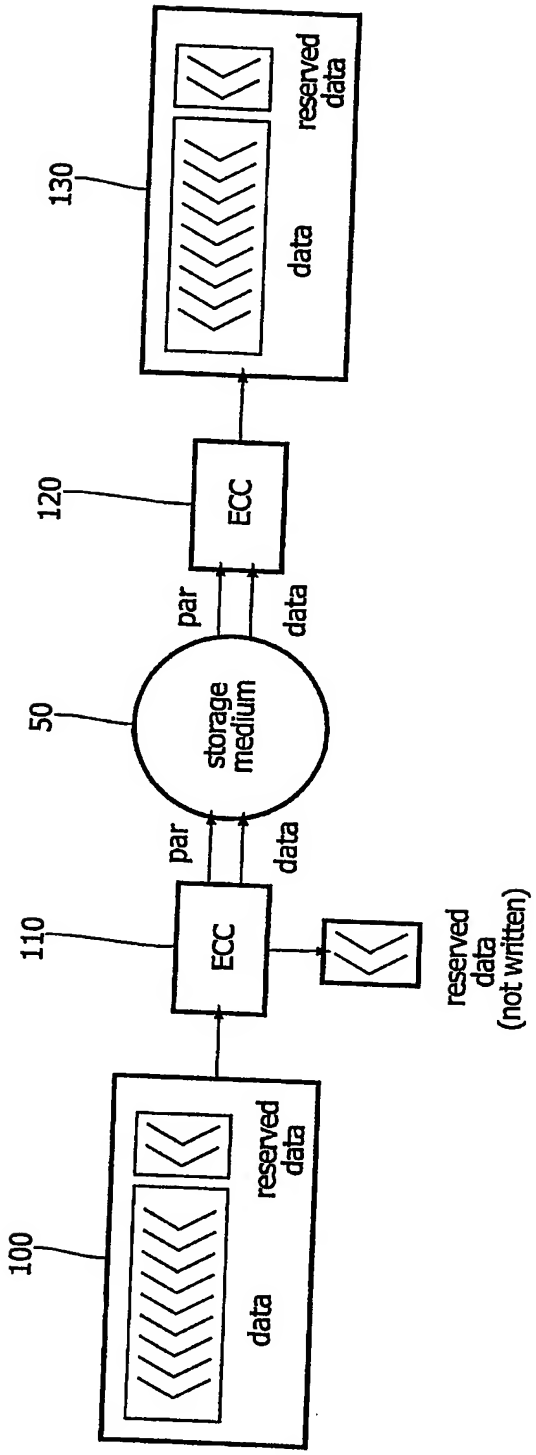
130
data
reserved data
120
ECC
par
data
50
storage medium
par
data
110
ECC
reserved data (not written)
100
data
reserved data

FIG.20

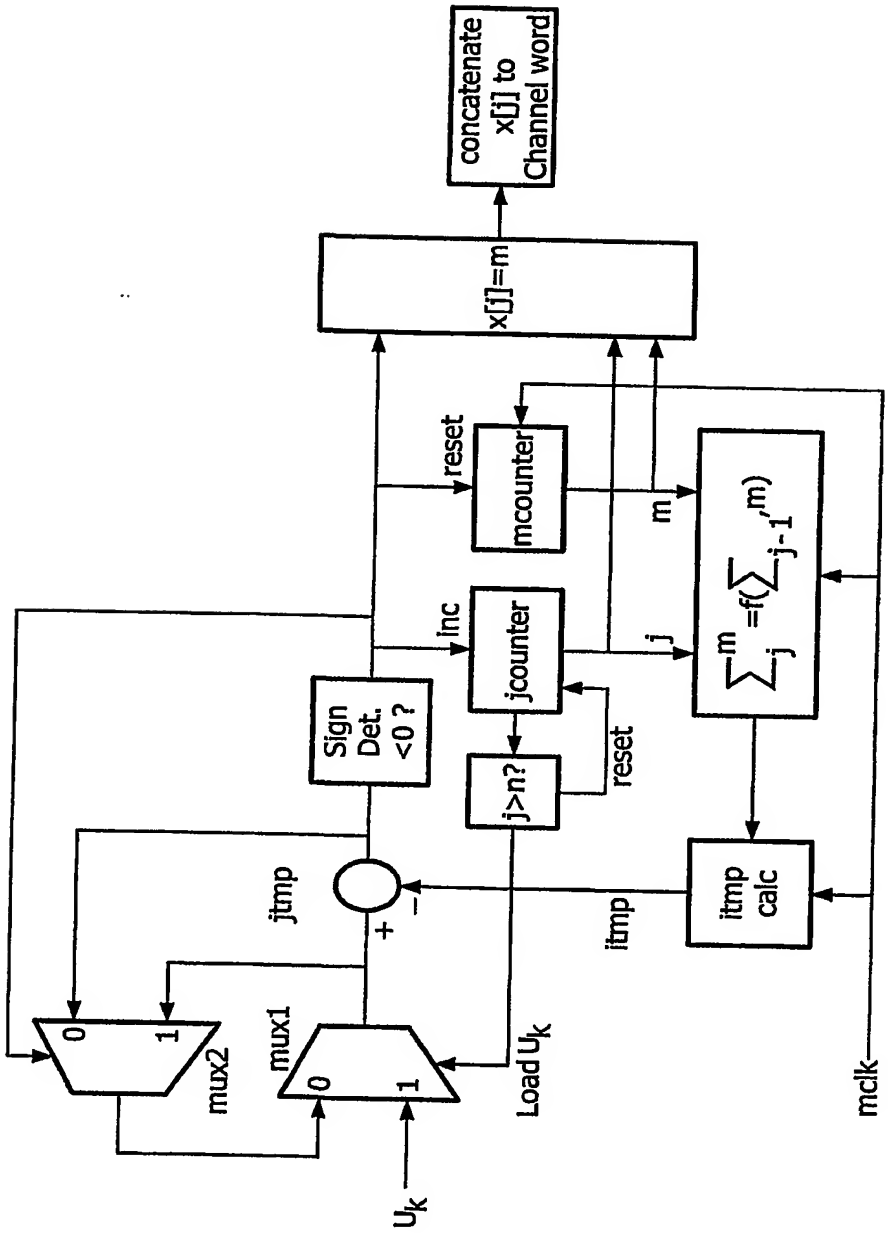
concatenate x[j] to Channel word
x[j]=m
reset
mcounter
m
$\sum_{j}^{m} = f(\sum_{j-1}, m)$
inc
jcounter
j
Sign Det. <0 ?
j>n?
reset
jtmp
+
−
itmp
itmp calc
0
1
mux2
mux1
0
1
Load U_k
U_k
mclk

FIG.21

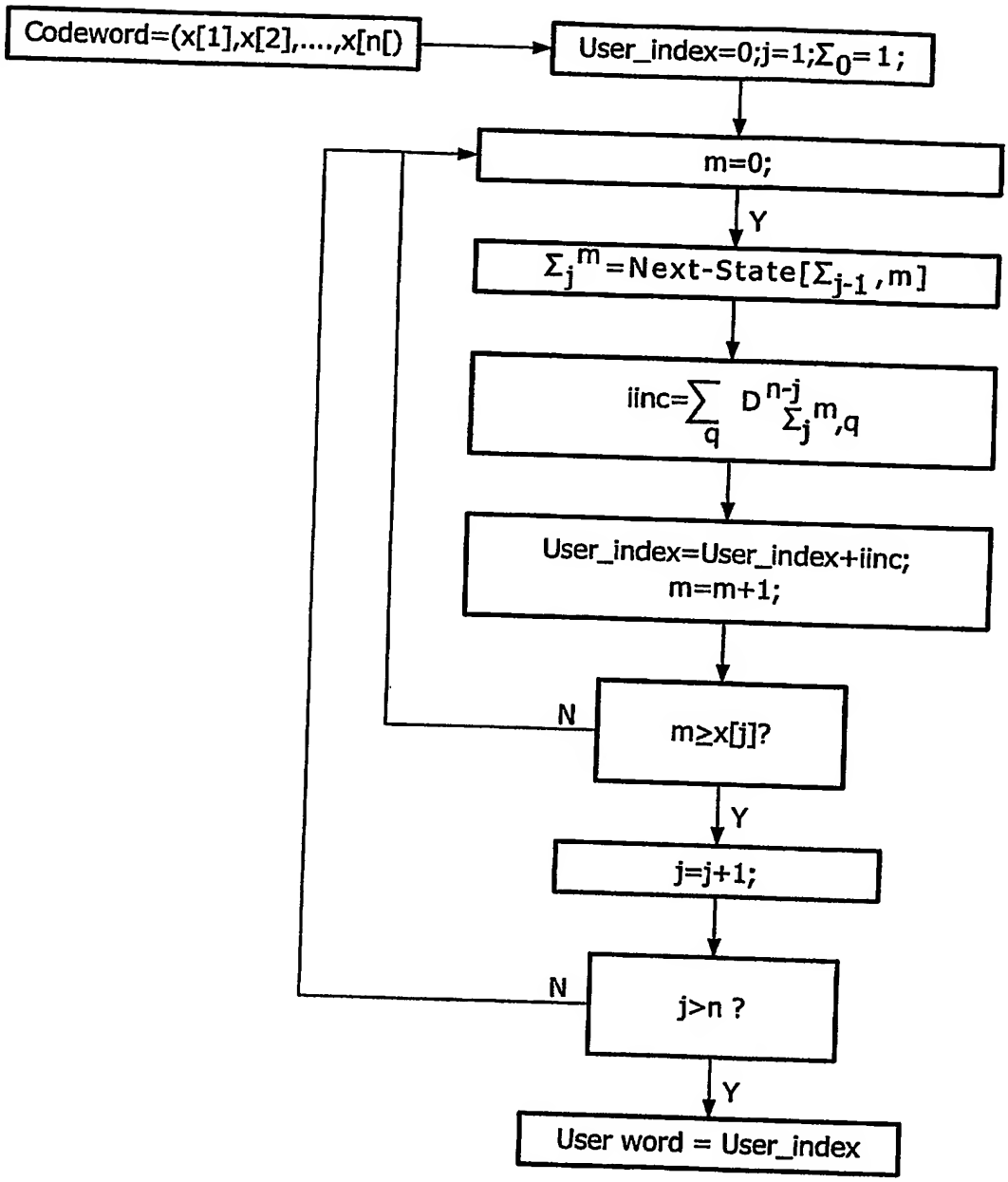
Codeword=(x[1],x[2],....,x[n[)
User_index=0;j=1;Σ0=1;
m=0;
Y
Σj m=Next-State[Σj-1,m]
iinc=∑q Dn-j Σj m,q
User_index=User_index+iinc;
m=m+1;
N
m≥x[j]?
Y
j=j+1;
N
j>n ?
Y
User word = User_index

FIG.22

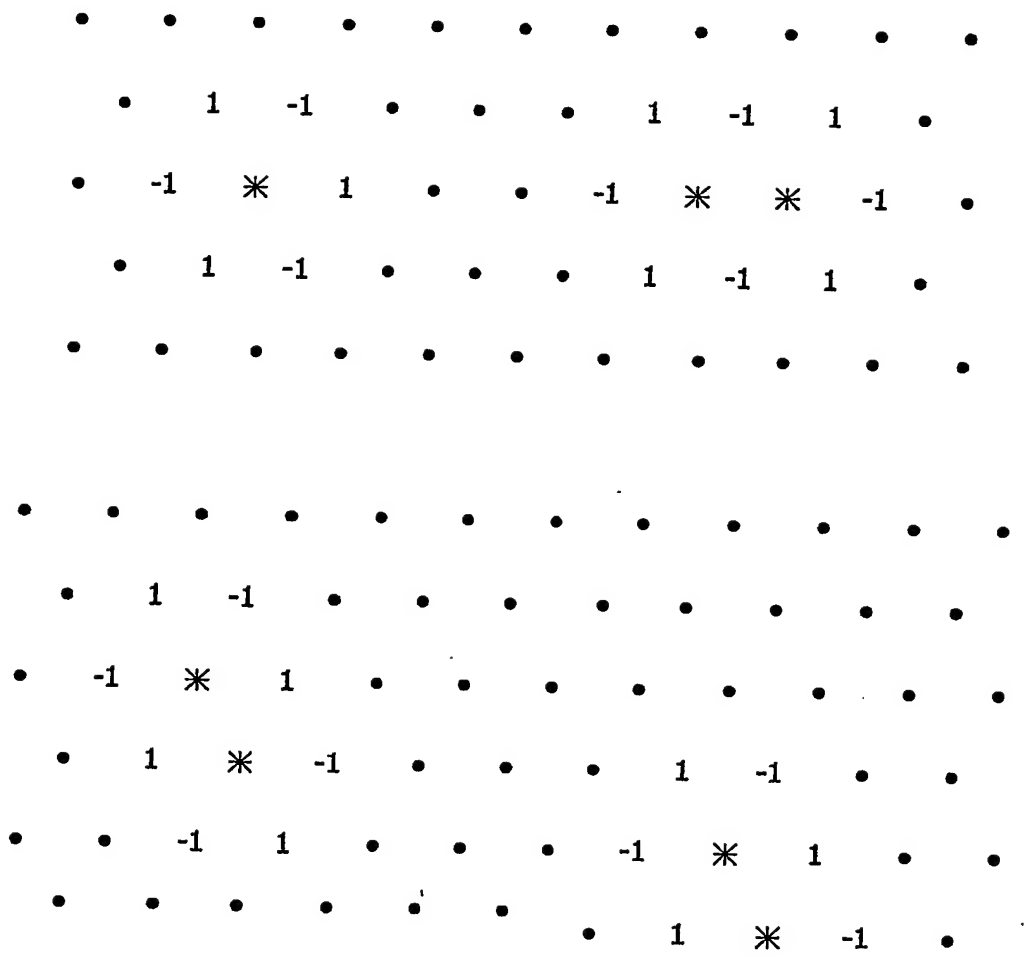

FIG.23

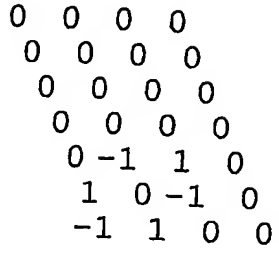

FIG.24a

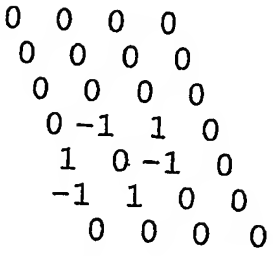

FIG.24b

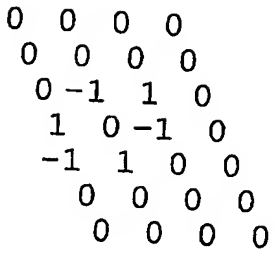

FIG.24c

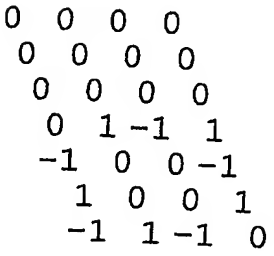

FIG.24d

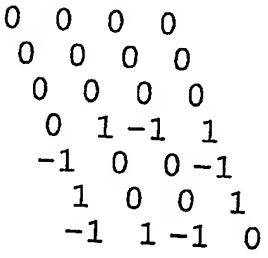

FIG.24e

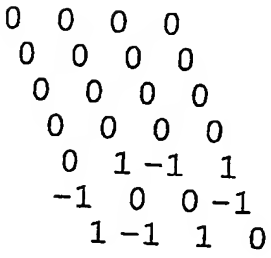

FIG.24f

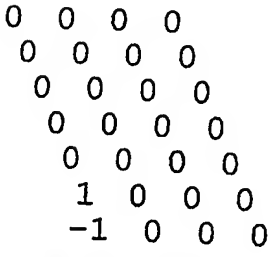

FIG.24g

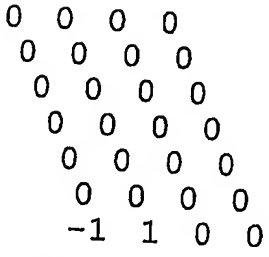

FIG.24h

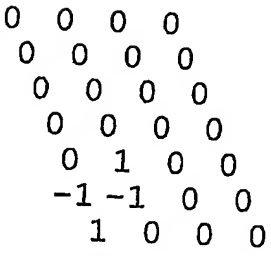

FIG.24i

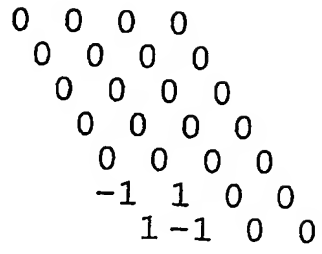

FIG.25a

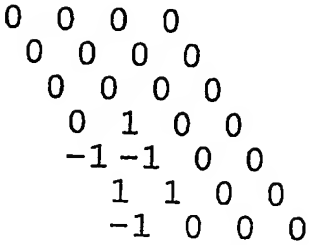

FIG.25b

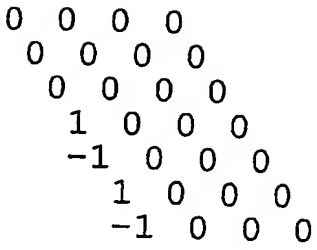

FIG.25c

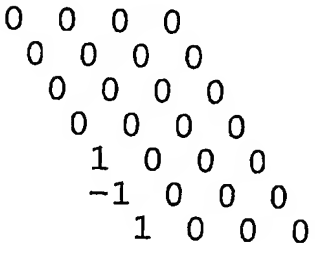

FIG.25d

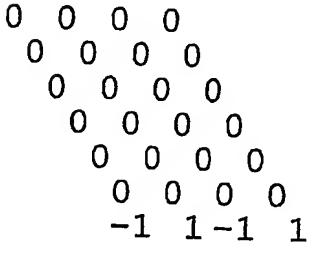

FIG.25e

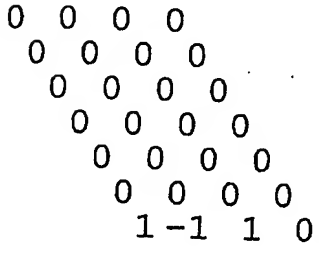

FIG.25f

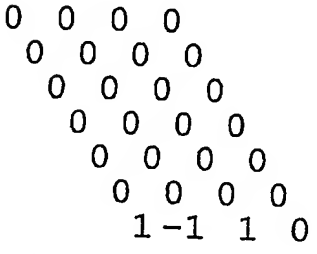

FIG.25g

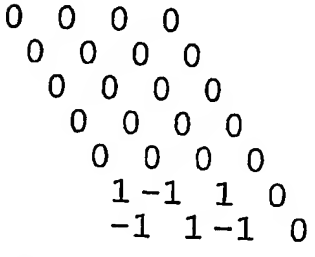

FIG.25h

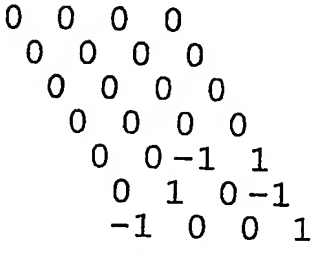

FIG.25i

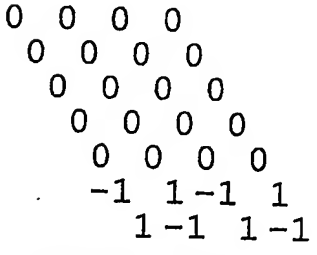

FIG.25j

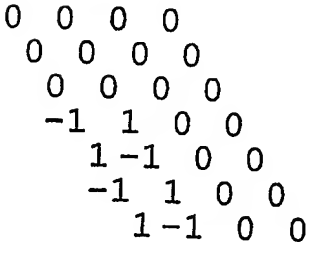

FIG.25k

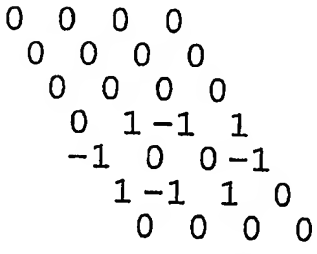

FIG.25l

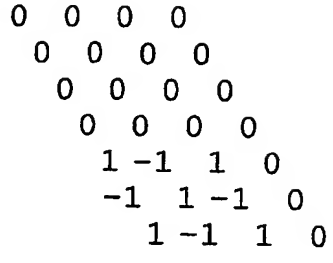

FIG.26a

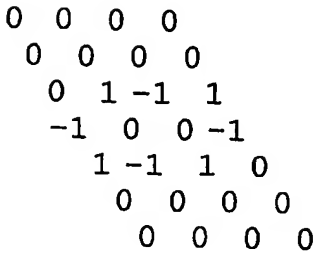

FIG.26b

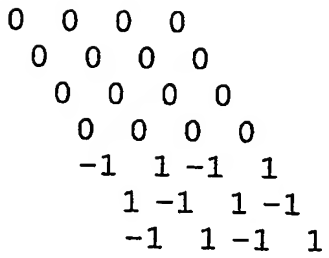

FIG.26c

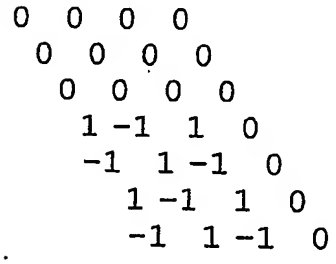

FIG.26d

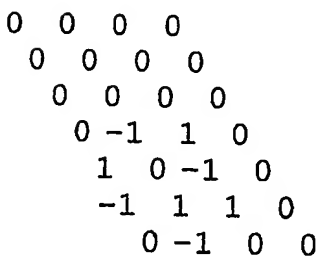

FIG.26e

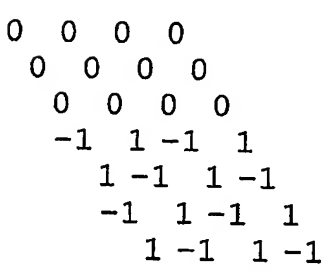

FIG.26f

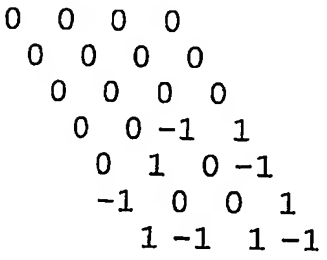

FIG.26g

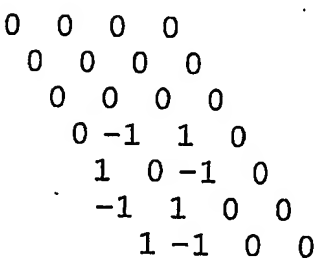

FIG.26h

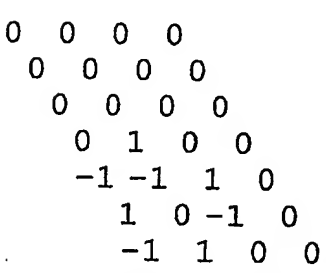

FIG.26i

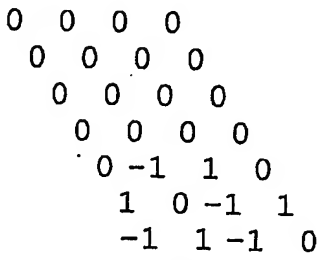

FIG.26j

$$\begin{matrix} 0 & 0 & 1 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & 1 & -1 & 0 \\ 0 & 0 & 0 & 0 \end{matrix}$$

FIG.27a

$$\begin{matrix} 0.0057 & 0 & 0.0339 & 0 & 0.0339 & 0 & 0.0057 \\ 0 & -0.0339 & 0 & 0.3607 & 0 & -0.0339 & 0 \\ 0.0254 & 0 & 0.0000 & 0 & 0.0000 & 0 & 0.0254 \\ 0 & -0.3607 & 0 & 0.2407 & 0 & -0.3607 & 0 \\ -0.0339 & 0 & -0.2407 & 0 & -0.2407 & 0 & -0.0339 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0.0339 & 0 & 0.2407 & 0 & 0.2407 & 0 & 0.0339 \\ 0 & 0.3607 & 0 & -0.2407 & 0 & 0.3607 & 0 \\ -0.0254 & 0 & -0.0000 & 0 & -0.0000 & 0 & -0.0254 \\ 0 & 0.0339 & 0 & -0.3607 & 0 & 0.0339 & 0 \\ -0.0057 & 0 & -0.0339 & 0 & -0.0339 & 0 & -0.0057 \end{matrix}$$

FIG.27b

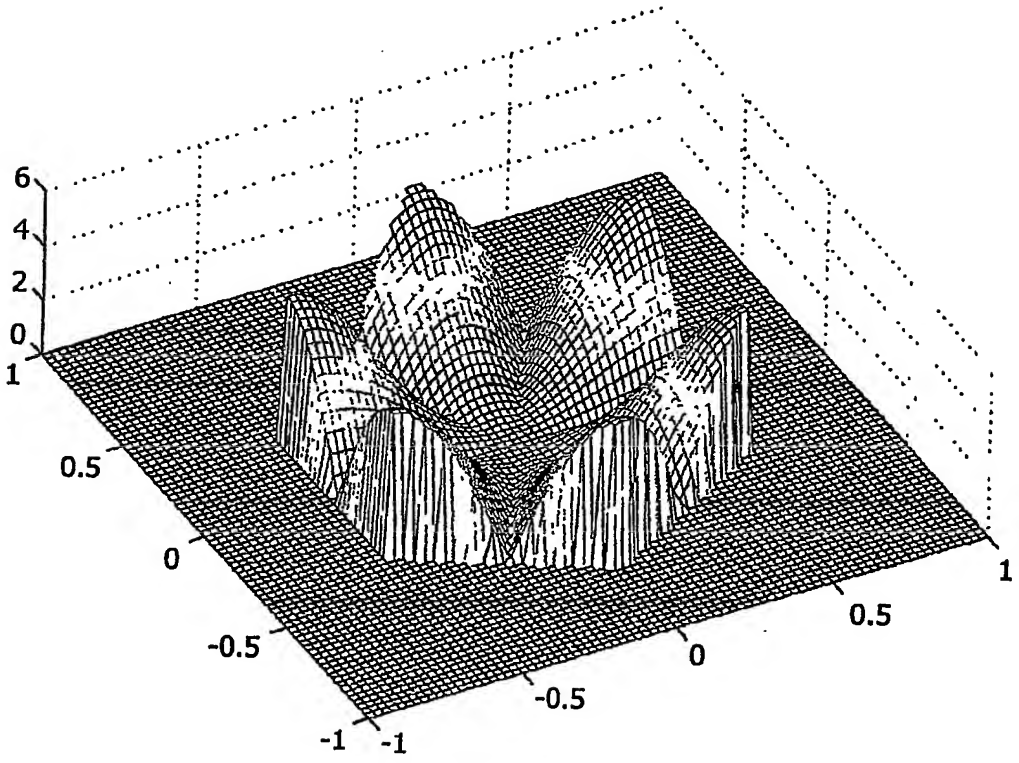

FIG.28

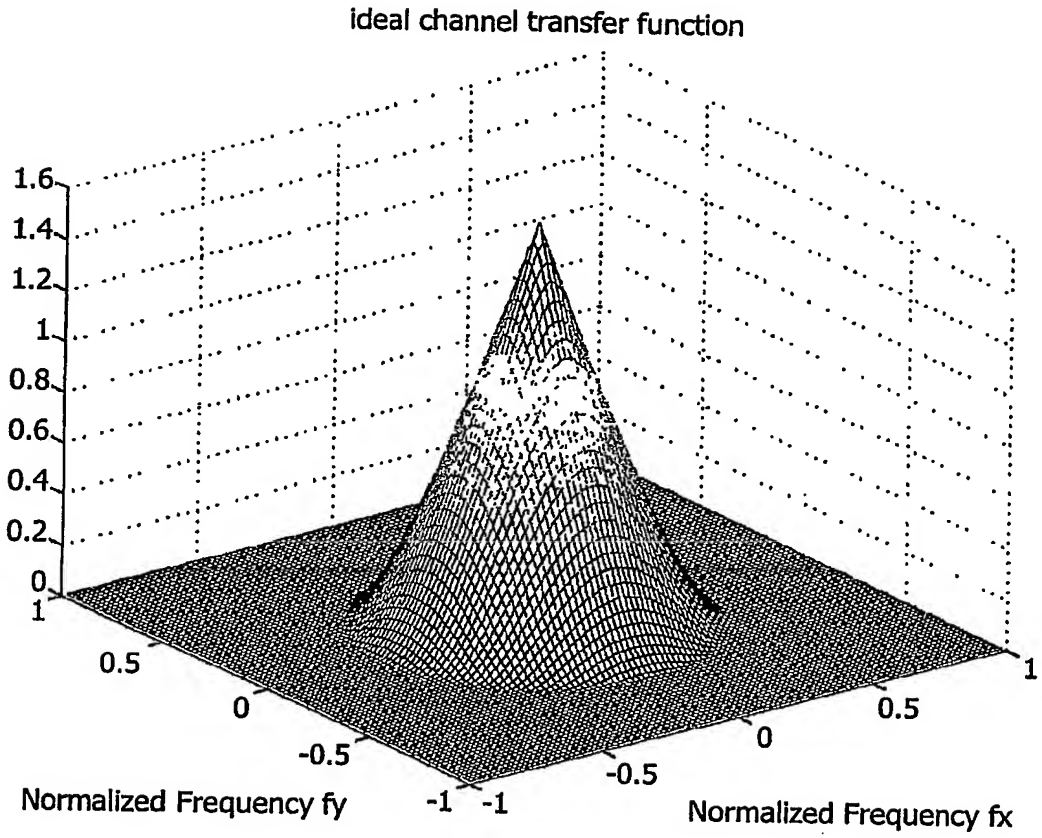
ideal channel transfer function
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1
0.5
0
-0.5
-1
Normalized Frequency fy
-1
-0.5
0
0.5
1
Normalized Frequency fx

FIG.29